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Advanced Swarm UAV Capabilities through Collaborative Field Experimentation

Davis, Duane; Jones, Kevin; Jones, Marianna; Giles, Katy

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Advanced Swarm UAV Capabilities through Collaborative Field Experimentation

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A R S E N A L
Advanced Robotic Systems Engineering Laboratory



Swarm Concept to Capability



2017-2018 Summary

- **Adversarial Multi-Swarm Events**
 - Service Academy Swarm Challenge
- **Technology Fleet Transition**
 - USMC Tactical Training and Exercise Control Group (29 Palms)
- **Platform Development**
 - Fixed wing and quadrotor
- **Tactical Swarm Behavior Development**
 - Realistic OPFOR in live training environments
 - Distributed autonomy and emergence

Background & History

- **Counter-Swarm Focus Beginning in 2011**
 - **Research Objective:** development & live-fly demonstration of capabilities required for saturation attack defense using autonomous swarms
 - Competition-based approach to collaborative development
 - Leverage open source & hobby communities, COTS, & additive mfg.
- **Milestones**
 - Single-UAV ops from 2012 to 2014
 - 50-vehicle (fixed-wing) swarm demonstration in August 2015
 - Multi-swarm capability demonstration in December 2015
 - Adversarial swarm versus swarm events in 2017
 - Heterogeneous swarms (fixed-wing & quadrotor) in 2017

Looking Forward

- **Platform Development**
 - Improved performance, operability, and maintainability
 - Sensor integration, modularity...
- **Swarm Capability Development**
 - Heterogeneous swarms
 - Consensus & market-based approaches to distributed decision making
 - Counter-swarm & swarm versus swarm
- **Human-Swarm Interaction**
 - Composeable and mathematically rigorous behavior framework
 - Paradigms supporting more robust behaviors & improved performance
 - Intuitive & flexible C2 & interface models

